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REMARKS

In this Preliminary Amendment, claims 42, 49, 50, 53-55, 61 and 64 have been amended, no claims have been canceled or new claims added. Therefore, claims 1-18 and 42-64 are pending for consideration by the examiner.

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With respect to claims 42 and 55, applicant notes at least the following differences from the applied prior art (USP 6,097,473 – Ota et al.) in the Office Action in the parent of the current application.

In the prior Office Action, the Office Action states "Ota et al. disclose a determining step of determining an order for positioning each of the areas to detected into the predetermined detecting field by using at least one of an operation search technique and an evolutionary computation method; and a movement step of moving the substrate so as to sequentially position each of areas to be detected into the predetermined detecting field in accordance with the order determined in the determining step" and further states "Ota et al, also disclose that the order determined in the determining step is a solution of a most preferable movement sequence, based on an overall movement time between the areas to be detected, the evolutionary computation includes a genetic algorithm, each of the areas to be detected has alignment mark.". However, Ota et al. does not teach or suggest the specific steps or apparatus recited in these claims as asserted in the Office Action.

With respect to claims 51 and 62, applicant notes at least the following differences from the applied prior art (USP 6,141,107 – Nishi et al.).

In the prior Office Action, the Office Action stated "Nishi et al. disclose that a first step of detecting at least one of a plurality of first measurement marks provided associated with a predetermined shot area out of the shot areas; a second step of detecting at least one of a plurality of second measurement marks provided associated with a shot area different from the predetermined shot area, before detecting all of the first measurement marks; a third step of detecting or a more remaining first measurement marks which are not detected in said first step, after the second step and a plurality of shot area are provided the substrate." However, Nishi et al. does not appear to support the Examiner's assertion.

For example, Fig. 8 of Nishi et al. simply teaches that the alignment marks respectively provided associated with the shot areas Nos. 1-8 are measured in the order of the number shot area (No. 1 → No. 2 → No. 3 → ... → No. 8). It, also ,teaches (a) that a mark detection of the adjacent shot area (No. 4a) is performed when a mark detection of the shot area of No. 4 is failed (sequence for this case: No. 1 → ... → No. 4 → No. 4a → No. 5 → ... → No. 8), or that the shot area of No. 4b is measured when the shot area of No. 4a is further failed (sequence for this case: No. 1 → ... → No. 4 → No. 4a → No. 4b → No. 5 → ... → No. 8). As described above, Nishi et al. does not teach or suggest detecting a part (for example, right side mark) of marks in the shot area of No. 1, sequentially detecting the marks in the shot area of No. 2, and thereafter detecting the remaining (left side mark) of marks in the shot area of No. 1.

Differences from documents cited in the concurrently filed IDS.

First, with respect to claims 1-18 and IDS documents B1-B3, these documents do not teach or suggest to determine the measurement order for a plurality of area (alignment marks) to be measured prior to the alignment step of aligning each chip area on the substrate to a transfer position of a reticle pattern.

Second, with respect to IDS documents B1-B3 and claims 42 and 55, these documents do not teach or suggest the use of at least one of Nearest Neighbor method, Lin and Kernighan's approach , k-OPT method, and evolutionary computation method. The Dueck document (U.S.P. No. 5,200,677) teaches detecting the movement sequence by using "threshold accepting method", but this method does not correspond to one of the above Nearest Neighbor method, Lin and Kernighan's approach, k-OPT method, and evolutionary computation method.

Third, with respect to IDS documents B1-B3 and claims 51 and 62, these claims require a sequence such that a mark provided with a second shot area is detected after detecting a part of the plurality of marks provided with the first shot area, and thereafter the remaining part (including non-measured marks) provided on the first shot area is detected. These recited features are not disclosed or suggested by IDS documents B1-B3.

If there are any questions regarding the application or if an examiner's amendment would facilitate allowance of one or more claims, the examiner is invited to contact the undersigned attorney at the local number below.

Respectfully submitted,

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MARKED UP VERSION OF CLAIMS CHANGES IN AMENDMENT FILED ON AUGUST 9, 2001

42. (Amended) A mark detecting method of sequentially detecting a plurality of areas to be detected on a substrate by using a detecting device having a predetermined detecting field, said method comprising [steps of]:

a determining step of determining an order for positioning each of the areas to be detected into the predetermined detecting field by using at least one of [an operations-research technique and an evolutionary computation method] a Nearest Neighbor method, a Lin and Kernighan's approach, a k-OPT method, an evolutionary computation method and a combination; and

a movement step of moving the substrate so as to sequentially position each of the areas to be detected into the predetermined detecting field in accordance with the order determined in said determining step.

49. (Amended) A method of exposing a predetermined pattern onto each of a plurality of shot areas on a substrate, said method comprising:

a detecting [a plurality of alignment marks by using said mark detecting method according to claim 47;] step of sequentially detecting a plurality of areas to be detected on the substrate by using a detecting apparatus having a predetermined detecting field, each of the areas to be detected having an alignment mark, said detecting step comprising:

a determining step of determining an order of positioning each of the areas to be detected into the predetermined detecting field by using at least one of a Nearest Neighbor method, a Lin and Kernighan's approach, a k-OPT method, an evolutionary computation method and a combination there of; and

a movement step of moving the substrate so as to sequentially position each of the areas to be detected into the predetermined detecting field in accordance with the order determined in said determining step; and

a transferring step of controlling a position of the substrate, based on the detected results in said detection of alignment mark[;], and sequentially transferring the predetermined pattern onto the shot areas.

50. (Amended) A method of manufacturing a device, comprising [sequentially transferring a device pattern onto a plurality of shot areas by using said method according to claim 49.]:

a detecting step of sequentially detecting a plurality of areas to be detected on the substrate by using a detecting apparatus having a predetermined detecting field, each of the areas to be detected having an alignment mark, said detecting step comprising:

a determining step of determining an order of positioning each of the areas to be detected into the predetermined detecting field by using at least one of a Nearest Neighbor method, a Lin and Kernighan's approach, a k-OPT method, an evolutionary computation method and a combination there of; and

a movement step of moving the substrate so as to sequentially position each of the areas to be detected into the predetermined detecting field in accordance with the order determined in said determining step; and

a transferring step of controlling a position of the substrate, based on the detected results in said detection of alignment mark, and sequentially transferring a device pattern onto the shot areas.

53. (Amended) A method of exposing a predetermined pattern onto each of a plurality of shot areas on a substrate, said method comprising:

a detecting [a plurality of measurement marks by using said method according to claim 52;] step of detecting a plurality of measurement marks provided associated with a plurality of shot areas arranged on a substrate said detecting step comprising:

a first step of detecting at least one of plurality of first measurement marks provided associated with a predetermined shot area out of the shot areas; and

a second step of detecting at least one of a plurality of second measurement marks provided associated with a shot area different from the predetermined shot area, before detecting all of the first measurement marks; and

a third step of detecting one or more remaining first measurement marks which are not detected in said first step, after said second step; and

a transferring step of controlling a relative position between each of the shot areas on the substrate and the predetermined pattern, based on the detected results in said detection of alignment mark[;], and sequentially transferring the predetermined pattern onto the shot areas.

54. (Amended) A method of manufacturing a device, comprising [sequentially transferring a device pattern onto a plurality of shot areas by using said method according to claim 52.]:

a detecting step of detecting a plurality of measurement marks provided associated with a plurality of shot areas arranged on a substrate, said detecting step comprising:

a first step of detecting at least one of plurality of first measurement marks provided associated with a predetermined shot area out of the shot areas;

a second step of detecting at least one of a plurality of second measurement marks provided associated with a shot area different from the predetermined shot area, before detecting all of the first measurement marks; and

a third step of detecting one or more remaining first measurement marks which are not detected in said first step, after said second step; and

a transferring step of controlling a relative position between each of the shot areas on the substrate and the predetermined pattern, based on the detected results in said detection of alignment mark, and sequentially transferring a device pattern onto the shot areas.

55. (Amended) A mark detecting apparatus which sequentially detects a plurality of areas to be detected on a substrate by using a detecting device having a predetermined detecting field, said apparatus comprising:

a determining device which determines an order for positioning each of the areas to be detected into the predetermined detecting field by using at least one of [operations-research technique and an evolutionary computation method] a Nearest Neighbor method, a Lin and Kernighan's approach, a k-OPT method, an evolutionary computation method and a combination; and

a movement device which is electrically connected to the determining device and which moves the substrate so as to sequentially position each of the areas to be detected into the predetermined detecting field, based on the order determined by said determining device.

61. (Amended) An exposure apparatus that sequentially exposes a predetermined pattern onto each of a plurality of shot areas on a substrate, said exposure apparatus comprising: [said apparatus according to claim 59,

wherein said exposure apparatus detects a plurality of alignment marks by using said detecting apparatus, controls a position of the substrate, based on the detected results in the detection of alignment mark, and sequentially transfers the predetermined pattern onto the shot areas.]

a mark detecting apparatus sequentially detecting a plurality of areas to be detected on the substrate by using a detection apparatus having a predetermined detecting field, each of the areas to be detected having an alignment mark, said detection apparatus comprising:

a determining device which determines an order for positioning each of the areas to be detected into the predetermined detecting filed by using at least one of a Nearest Neighbor method, a Lin and Kernighan's approach, a k-OPT method, an evolutionary computation method and a combination thereof; and

a movement device which is electrically connected to the determining device and which moves the substrate so as to sequentially position each of the areas to be detected into the predetermined detecting field, based on the order determined by said determining device; and

a transferring control apparatus which is electrically connected to the mark detecting apparatus and controls a position of the substrate, based on the detected results in the detection of alignment mark by said mark detecting apparatus, and sequentially transfers the predetermined pattern onto the plurality of shot areas.

64. (Amended) An exposure apparatus that exposes a predetermined pattern onto a plurality of shot areas on [said] a substrate, said exposure apparatus comprising: [said detecting apparatus according to claim 63,

wherein said exposure apparatus detects a plurality of measurement marks by using said detecting apparatus, controls a relative position between each of the shot areas on the substrate and the predetermined pattern, based on detected results in said detection of measurement marks by using said detecting apparatus, and sequentially transfers the predetermined pattern onto the shot areas.]

a mark detecting apparatus sequentially detecting a plurality of areas to be detected on the substrate by using a detection apparatus having a predetermined detecting field, each of the areas to be detected having an alignment mark, said detection apparatus comprising:

a determining device which determines an order for positioning each of the areas to be detected into the predetermined detecting field by using at least one of a Nearest Neighbor method, a Lin and Kernighan's approach, a k-OPT method, an evolutionary computation method and a combination thereof; and

a control device which is electrically connected to the determining device and controls said detecting device so as to detect a part of the first measurement marks, detect second measurement marks after detecting the part of the first measurement marks, and detect one or more remaining first measurement marks, which are not measured after detecting the second measurement marks; and

a transferring control apparatus which is electrically connected to the mark detecting apparatus and controls a position of the substrate, based on the detected results in the detection of alignment mark by said mark detecting apparatus, and sequentially transfers the predetermined pattern onto the plurality of shot areas.